## Southern California Edison

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# Small Business Assistance Conference

# Update on the Energy Scenario

***Southern California Edison***
Stephanie Hamilton, Manager

## Selected SCE Programs

Stephanie L. Hamilton, SCE

AQMD's Small Business Assistance Program
Brea, CA
October 21, 2002

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## Energy Efficiency Programs

- Express Efficiency for:
  - Air Conditioning
  - Refrigeration
  - Lighting
  - Irrigation, Agriculture & Motors
- Standard Performance Contract allows program customization for customers

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## Topics

- Brief Summaries of SCE Customer Programs in
  - Energy Efficiency
  - Load Reduction
  - Self-Generation Incentive
- Overview of SCE's microturbine generator [MTG] testing program

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## Energy Efficiency Programs Contact Options

- Website – www.sce.com
  - **(select "Rebates and Offers")**
- Reservations 800.736.4777
- Technical Support Line
  - **800.736.4777 or 626.302.1724**
- Operations Center 626.302.3818
- E-mail – Bizrebate@sce.com
- Jacqueline Jones, Project Manager
  - **626.302.8798**
  - **or e-mail** Jacqueline.Jones@sce.com

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## Express Energy Efficiency Programs

- Rebates for Small and Medium Sized Business Customers
- Small to Medium Business Customers Maximum monthly demand of 500kW
- Direct customer rebates for prescribed energy efficient equipment retrofits

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## Load Reduction Programs

- Help qualifying customers reduce their energy usage during peak times, while lowering their electricity costs.
- Qualifying customers who can reduce power when statewide energy supplies are low may earn financial incentives and/or other benefits by participating in these programs.
- Doing so, can make a difference in the state's energy and economic well-being.

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# Update on the Energy Scenario

***Southern California Edison***
Stephanie Hamilton, Manager

## Business Customer Load Reduction Programs*

- The Demand Bidding Program (DBP)
- The Base Air Conditioner Cycling Program (GS-APS)
- Enhanced Air Conditioner Cycling Program (GS-APS-E)
- Base Interruptible Program (I-6-BIP)
- The Interruptible Service Program
- The Agricultural and Pumping Interruptible Service Program The Scheduled Load Reduction Program (SLRP)
- Optional Binding Mandatory Curtailment Program (OBMC)
- SCE's Peak Load Reduction Program
- The SCE Energy$mart Thermostat Program

* some have required a minimum customer load level

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## Self-Generation Incentive Program [SGIP]

- Provides financial incentives for new self-generation equipment – programs continues through 12/31/04
- Implemented to reduce electricity demand in California
- State-wide program Administrators are:
  - PG&E
  - SCE
  - SoCalGas,
  - SDG&E, San Diego Regional Energy Office

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## Load Reduction Programs

| Program / Feature | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | • | • | • | • | • | • | • | • | • |
| | • | • | • | • | • | • | • | • | • |
| | • | • | • | • | • | • | • | • | • |
| | • | • | • | • | • | • | • | • | • |
| | | | | | | | | | |
| | • | • | • | | • | • | • | • | • |
| | • | • | • | • | • | • | • | • | • |
| | • | • | • | • | • | • | • | • | • |
| | No | Yes | Yes | Yes | No | | No | Yes | No |
| | | | | | | | | | |
| | Reliability | Reliability | Reliability | Reliability | Reliability | Reliability | Reliability | Reliability | |

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## SGIP Program Budgets

Annual incentive budgets authorized by the CPUC are as follows:

| | |
|---|---|
| Pacific Gas and Electric Company | $48,000,000 |
| Southern California Edison Company | $26,000,000 |
| Southern California Gas Company | $13,600,000 |
| San Diego Regional Energy Office | $12,400,000 |

Year to Date SCE Incentive Paid:
Projects: 5 Capacity: 1.5 MW Incentives paid: $1.2M

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## Load Reduction Programs Contact Options

- Website – www.sce.com
  - **(select "Load Reduction Incentives')**
- Information at 800.423.9896
- Mark Wallenrod, Manager
  - **626.302.8331**
  - **or e-mail** Mark.Wallenrod@sce.com

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## SGIP Eligible Technologies & Incentive Levels

| Incentive Category | Incentive ($/Watt) | Max. % of Project Cost | Min. System Size | Max.System Size for Incentive Payment | Eligible Technologies |
|---|---|---|---|---|---|
| Level 1 | $4.50/W | 50% | 30 kW | 1 MW | • Photovoltaics<br>• Wind turbines<br>• Fuel cells (renewable fuel) |
| Level 2 | $2.50/W | 40% | None | 1 MW | • Fuel cells (non-renewable fuel) |
| Level 3 - R | $1.50/W | 40% | None | 1 MW | • Microturbines (renewable fuel)<br>• IC engines and small gas turbines (renewable fuel) |
| Level 3 - N | $1.00/W | 30% | None | 1 MW | • Microturbines<br>• Internal combustion engines<br>• Small gas turbines |

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# Update on the Energy Scenario

***Southern California Edison***
Stephanie Hamilton, Manager

## SGIP Contact Information

- **Program Information**
  - Program overview, handbook, applications, etc.
  - Website: **www.sce.com/sgip**
- **Program Support**
  - **Howard Green**
    **626.302.8436**
    **greenh@sce.com**
- **Program Management**
  - **Robert Thomas**
    **626.302.1746**
    **Robert.Thomas@sce.com**

## Capstone 28 kW

- Model 330 rated output: 30 kW at ISO
- 480 VAC, 3-phase, 60 Hz
- Recuperated single stage radial flow compressor and turbine on a single shaft, integrated with generator
- Equipped with a low NOx combustor
- Not equipped with a waste heat recovery boiler
- Fourth generation unit
- One unit only capable of grid connect
- One unit capable of stand alone and grid connect operation

## SCE Microturbine Generator (MTG) Testing Program

**Goal & Objectives:**

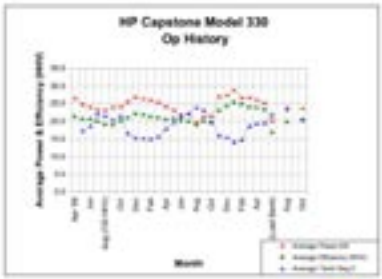
**Goal:** determine the performance, reliability, operability, availability, maintainability, and overall characteristics of commercially available MTGs.

**Objectives:** compare MTGs' actual performance to performance specifications & industry/other standards, such as emissions.

**Accomplishments:**

- $3.0+ million program in progress since 1998
- 13 different MTGs tested or in test
- Two to four more MTGs expected for testing
- Over 60,000 hours of testing
- Implemented "live" browser enabling technology

## Capstone 28 kW




## SCE MTG Test Bed

- 4 test bays
- 400 amp 480 volt service
- 100 psig natural gas with ability to blend for lower Btu testing
- Cogen heat dissipation ability
- Instrumentation for gas and electricity
- Electronic data acquisition
- Standardized testing procedures
- Veteran on-site two-person testing crew
- Ability to do specialized/custom testing

## Testing Schedule & Status: 08/29/02

| | | |
|---|---|---|
| Capstone "B" 30 kW | Jan-97 | 958 Completed |
| Capstone "B" 30 kW | Jan-97 | 967 Completed |
| Capstone 10 Pack | Apr-97 | 26 Completed |
| Capstone "C" 30 kW | May-97 | 3,794 Completed |
| Capstone "C" 30 kW | Jul-97 | 2,879 Completed |
| Bowman 35 kW | Feb-99 | 100 Completed |
| Bowman 60 kW | Jun-99 | 60 Completed |
| Capstone HP 30 kW | Apr-99 | 21,564 Operating |
| Parallon 75 kW | Jun-00 | 5,806 Completed |
| Capstone LP 30 kW | Aug-00 | 15,915 Operating |
| Bowman 80 kW | Jun-01 | 5,899 Operating |
| Elliott 80 kW | Jan-02 | 1,588 Operating |
| Total | | 59,176 |

# Update on the Energy Scenario

***Southern California Edison***
Stephanie Hamilton, Manager

## Desirable Attributes vs. Test Parameters

- ATTRIBUTES
  - Heat rate 12,000 to 16,000 BTU/kWh
  - Good Part Load Performance
  - Emissions < 9 ppm
  - Power Quality < IEEE 519
  - Noise < 70 dBa
  - Endurance = 40,000 hours
  - Installation = Easy & Cheap
- TEST PARAMETERS
  - Overall unit efficiency
  - Net Power Output
  - Emissions
  - Power Quality
  - Noise
  - Endurance
  - Ease of Installation
  - Operability
  - Maintainability

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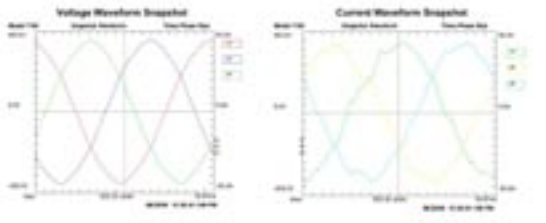
## Capstone Voltage & Current Waveforms



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## Capstone 28 kW Results

- Several overspeed trips were resulting from flame contr algorithm; Capstone remotely downloaded revised contr system software; no overspeed trips since software revi
- Reliable operation following resolution of overspeed
- Comparing manufacturer's efficiency and heat rate claim with test results converted to a common basis, resulted testing results consistent with claims as shown below @ 70°F, about sea level, and LHV:

| | (tested) | (claimed) |
|---|---|---|
| Efficiency | 23.7% ± 0.45% | 24.5% ± 0.5% |
| Heat rate | 14,415 BTU/kWh | 13,931 BTU/kWh |

## Honeywell 75 kW

- Parallon™ 75 kW at ISO
- 275 AC with Honeywell transformer option added to boost to 480 VAC, 3-phase, 60 Hz at site
- Recuperated single stage radial flow compressor and turbine on a single shaft, integrated with generator
- Not equipped with a heat recovery boiler – option is available
- Grid parallel or stand-alone operation
- Internal gas compressor

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## Capstone 28 kW Results

- Total Harmonic Distortion (THD) requirements specified by IEEE 519 were met:
  - Voltage THD: 1.6% measured average < 5% IEEE 519
  - Current THD: 5.67% measured average < 8% IEEE 519
- Noise measurement taken at 2m due to site conditions, e.g. obstructions and site compressor noise. Noise measured 70 dBA @ 2m, consistent with manufacturer's claim, 65 dBA, 10m.
- Emissions test results met SCAQMD requirements:

| Manufacturer Claim | SCAQMD Standard (Rule 1303) | Test Results NOx: < 9ppm |
|---|---|---|
| | | |
| | | |

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## Bowman 80 kW CHP

- Bowman 80 kW at ISO
- 480 VAC, 3-phase, 60 Hz
- Recuperated single stage radial flow compressor and turbine on a single shaft, integrated with generator
- Integrated heat recovery boiler
- In grid parallel operation

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# Update on the Energy Scenario

***Southern California Edison***
Stephanie Hamilton, Manager

## Elliott 80 kW

- Elliott 80 kW at ISO
- 480 VAC, 3-phase, 60 Hz
- Recuperated single stage radial flow compressor and turbine on a single shaft, integrated with generator
- Not equipped with a heat recovery boiler – option is available
- Grid parallel or stand-alone operation

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## Summary of Testing Results (cont.)

- 2000
  - Began testing Low Pressure [LP] Capstone
  - Began testing Honeywell
- 2001
  - Initial results for Capstones - both LP and upgraded HP
  - Honeywell results
  - Began testing Bowman
  - Elliott returned to manufacturer for upgrade
  - Elliot returned to test site and testing resumed
- 2002
  - Begin testing of Ingersoll-Rand
  - Seek other MTGS, such as Capstone 60 kW, Turbec 100 kW CHP
  - Finalize results for Capstones and Bowman

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## Future testing -- Ingersoll-Rand 70 kW

- Ingersoll-Rand 70 kW at ISO
- 480 VAC, 3-phase, 60 Hz
- A dual shaft recuperated MTG;
  - A radial flow compressor and gasifier turbine on one shaft,
  - A radial flow power turbine on the other shaft,
  - The power turbine drives the reduction gear and induction generator for grid parallel-only operation.
- Heat recovery boiler option available
- Internal gas compressor

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## Summary of Testing Results

- 1997 Testing of Capstone units (Beta, Charlie – pre-commercial)
  - Did not meet manufacturer's expectations
  - First & second generation units
  - Began testing "next generation" in 1999
- 1998 No MTGs commercially available to purchase and test
- 1999 Testing of Bowman units (pre-commercial)
  - Did not meet manufacturer's expectations
  - First generation units
  - Began testing "next generation" in 2001
- 1999 Testing of High Pressure [HP] Capstone unit
  - Met manufacturer's claims
  - Fourth generation unit
  - Began testing "next generation" in 2000

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## Los Angeles Department of Water and Power

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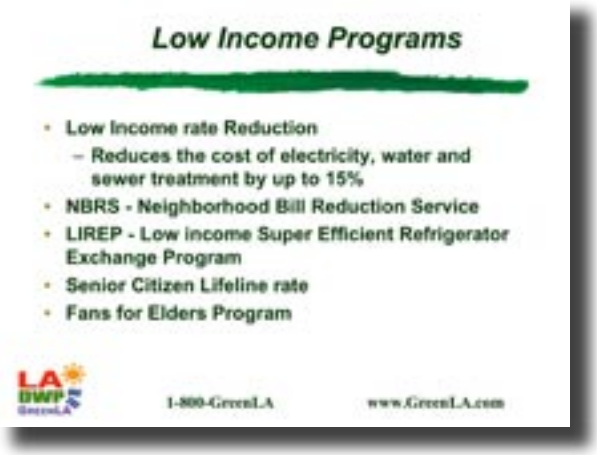
# Small Business Assistance Conference

Cleaning the air that we breathe...

# Update on the Energy Scenario

***Los Angeles Department of Water and Power***
Don Cunningham, Director of Efficiency Solutions





# Update on the Energy Scenario

***Los Angeles Department of Water and Power***
Don Cunningham, Director of Efficiency Solutions






# Update on the Energy Scenario

***Los Angeles Department of Water and Power***

Don Cunningham, Director of Efficiency Solutions





## Southern California Gas Company

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*Market Consultant*
Southern California Gas Company
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Email: cgoff@semprautilities.com

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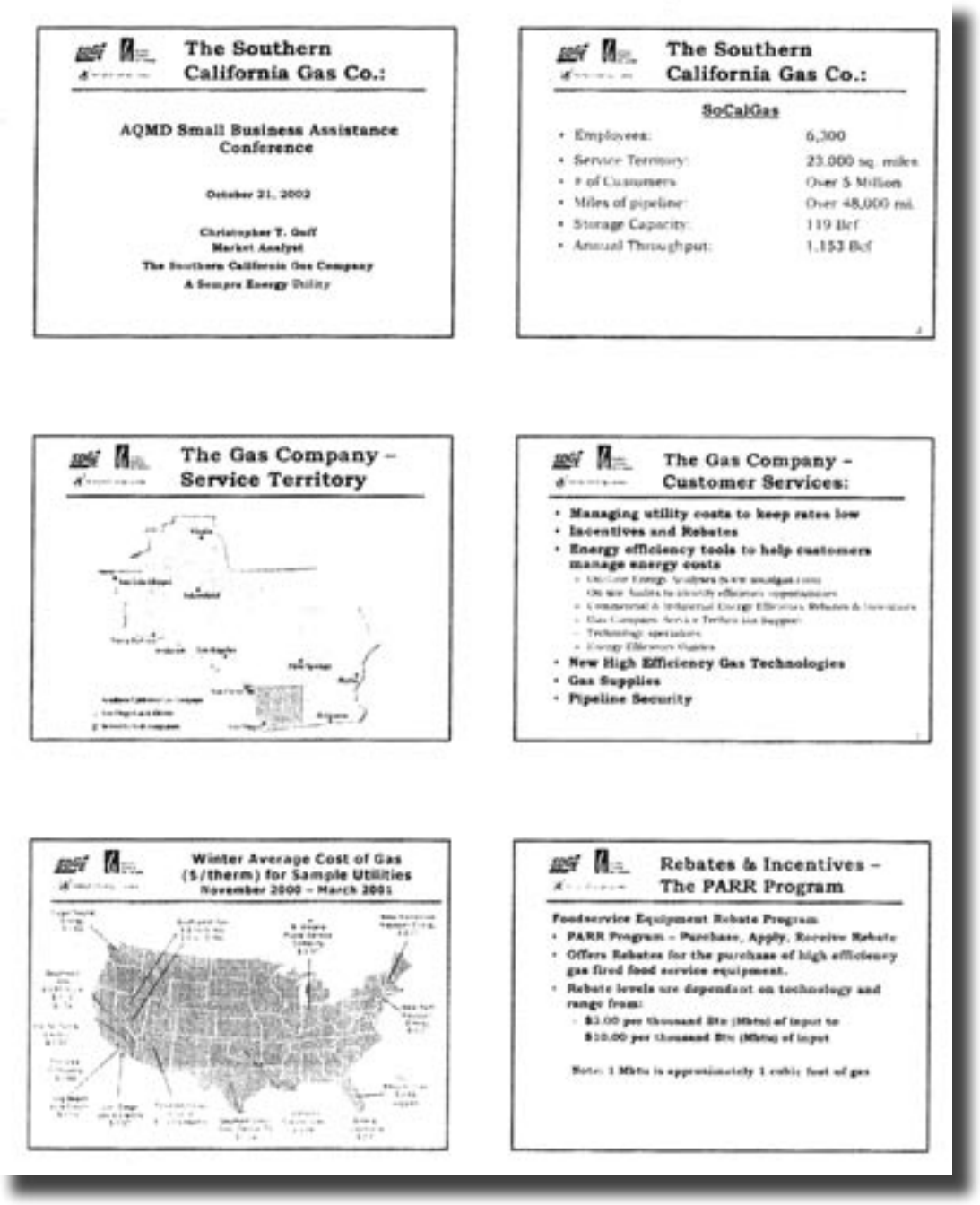
# Update on the Energy Scenario

***Southern California Gas Company***
Chris Goff, Marketing Consultant



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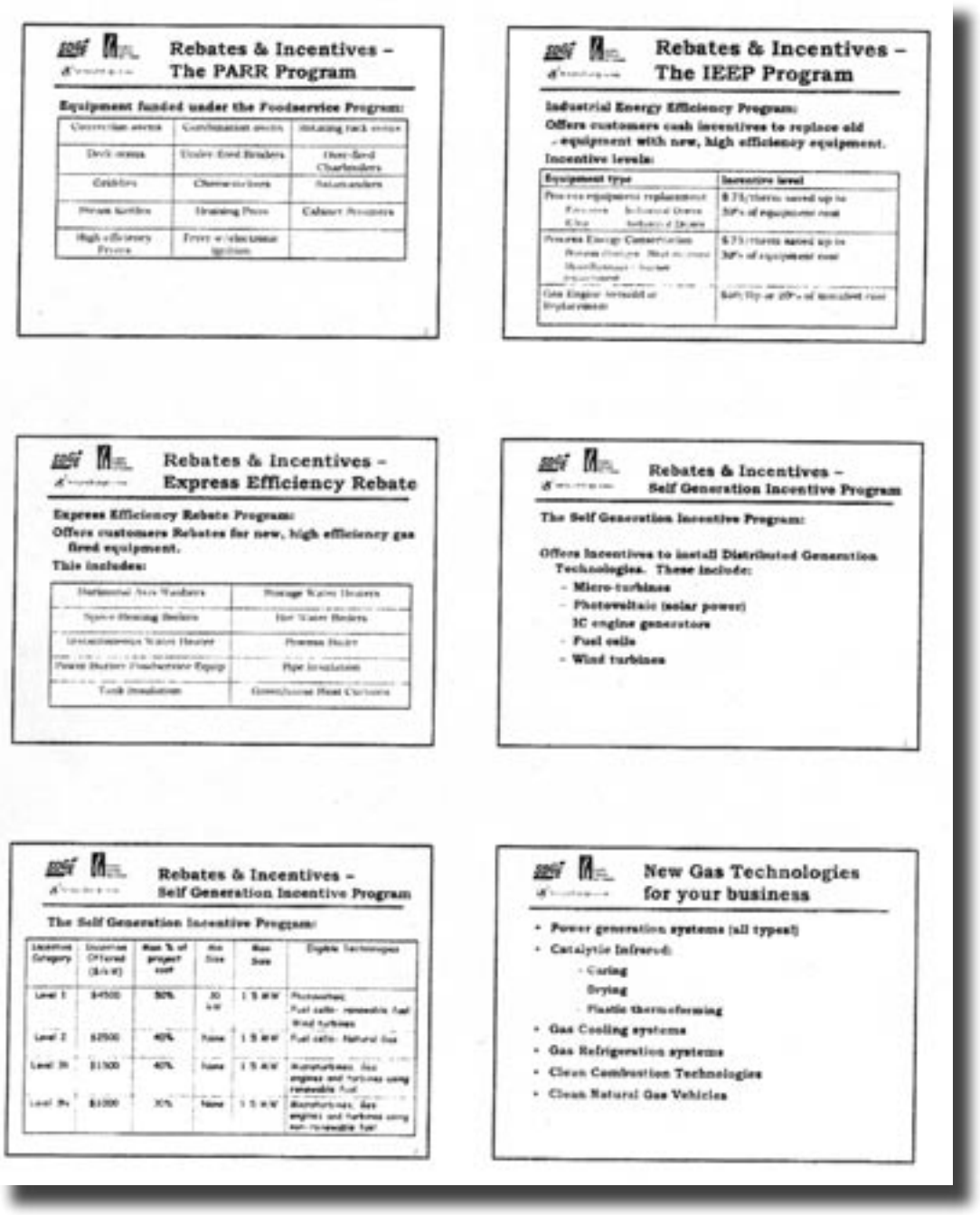

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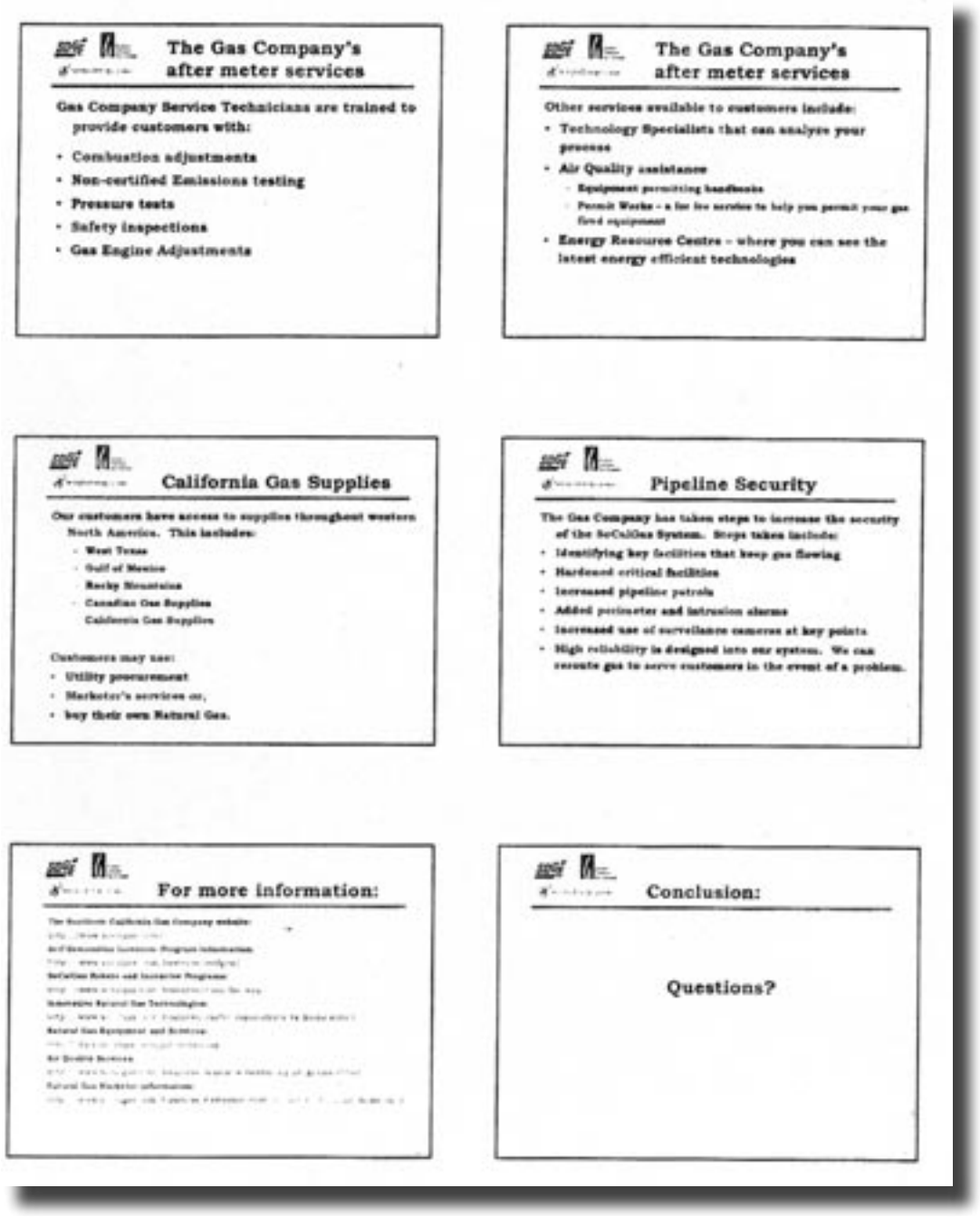

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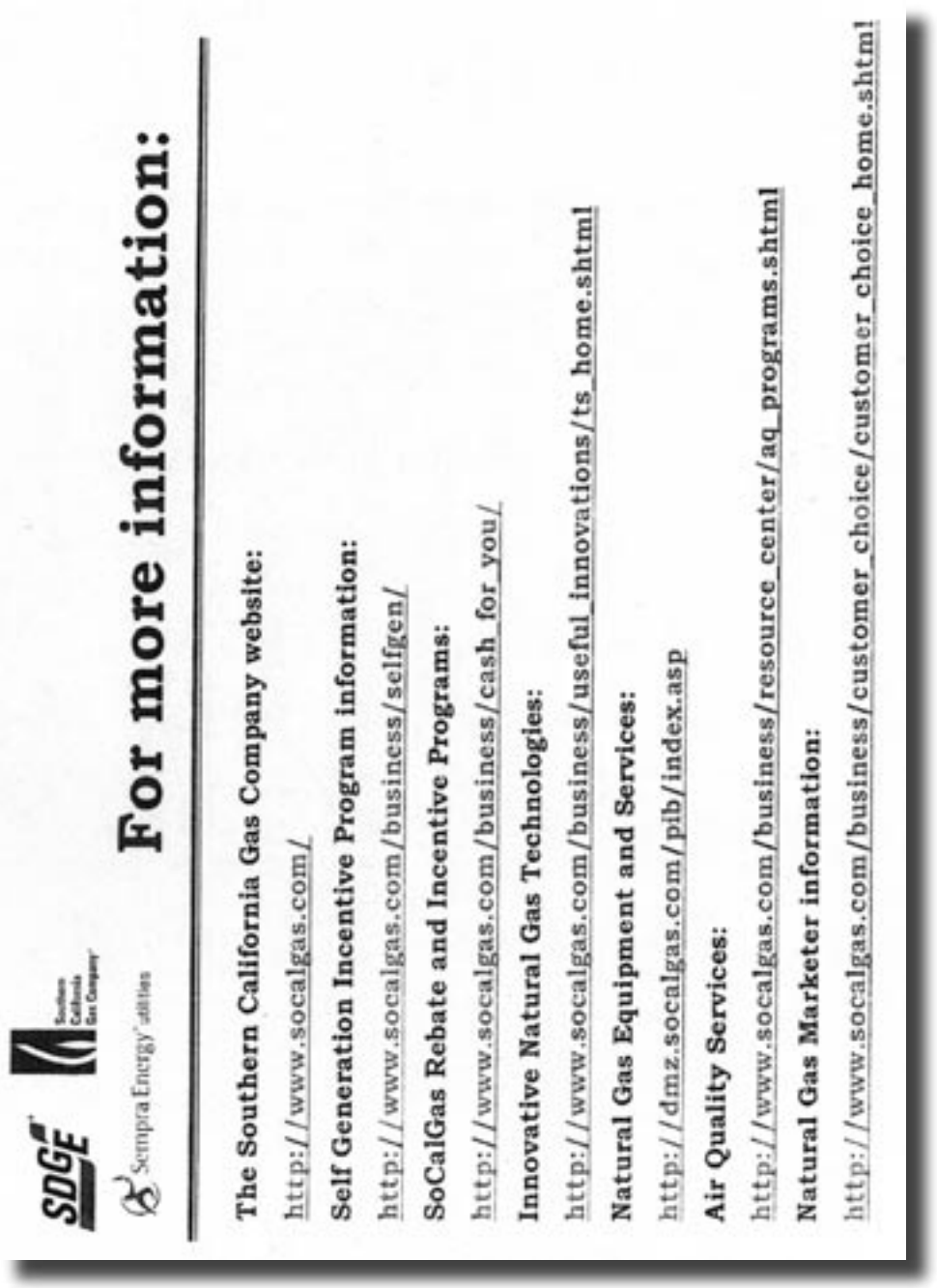

SDGE
Sempra Energy utilities

## For more information:

**The Southern California Gas Company website:**
http://www.socalgas.com/

**Self Generation Incentive Program information:**
http://www.socalgas.com/business/selfgen/

**SoCalGas Rebate and Incentive Programs:**
http://www.socalgas.com/business/cash_for_you/

**Innovative Natural Gas Technologies:**
http://www.socalgas.com/business/useful_innovations/ts_home.shtml

**Natural Gas Equipment and Services:**
http://dmz.socalgas.com/pib/index.asp

**Air Quality Services:**
http://www.socalgas.com/business/resource_center/aq_programs.shtml

**Natural Gas Marketer information:**
http://www.socalgas.com/business/customer_choice/customer_choice_home.shtml

# Small Business Assistance Conference

## California Energy Commission

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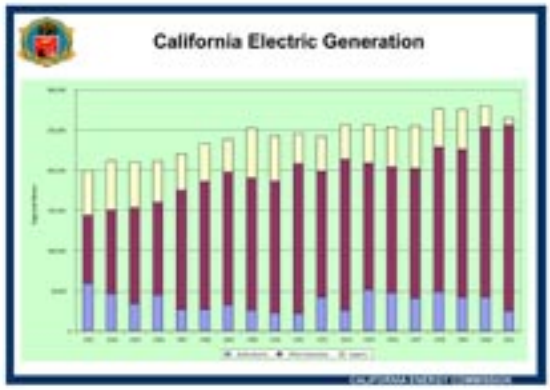
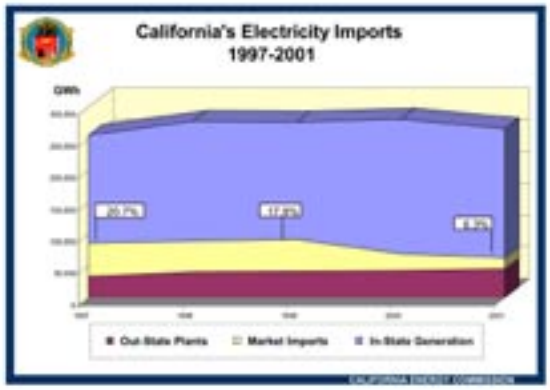
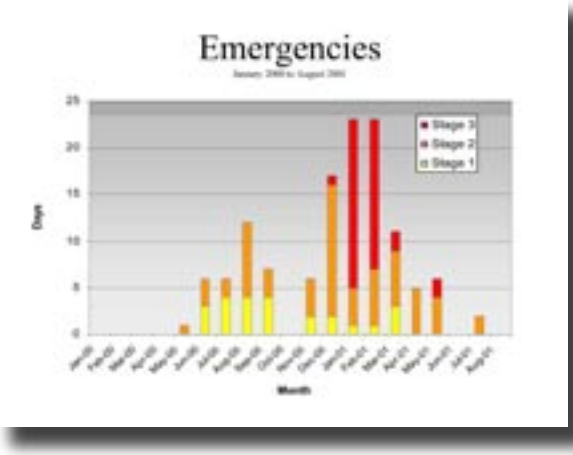
# Update on the Energy Scenario

***California Energy Commission***
Terrence O'Brien, Deputy Director

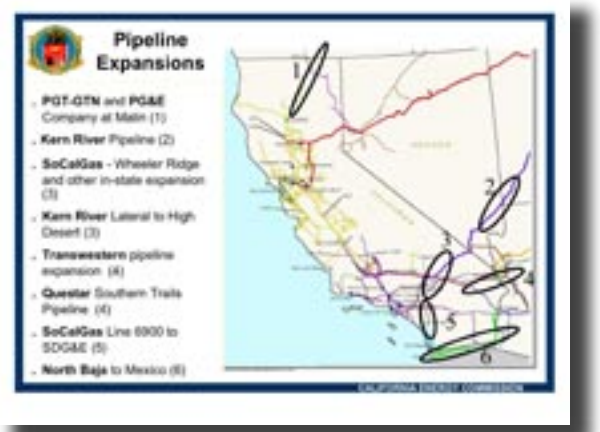




# Update on the Energy Scenario

***California Energy Commission***
Terrence O'Brien, Deputy Director




Permitting Options

| Permit | Authority | CEQA | Requirement |
|---|---|---|---|
| 12-Month AFC | PRC 25500+ | "EIR" | none |
| 6-Month AFC | AB 970 | "ND" | No Impacts |
| 4-Month AFC | AB 970<br>SB 28x | "ND" | No Impacts<br>On-line 2002 |
| Emergency Permit | PRC 25705 Declaration | NA | On-line 2001 |

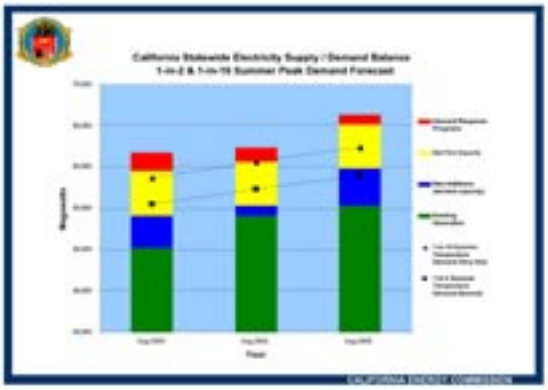

Components of Success

| Site | Developer | Agencies |
|---|---|---|
| Have proper zoning | Know project | Know process |
| Have "local" offsets | Clear internal comm. | Be flexible |
| Use reclaimed water | Open communication | Open communication |
| Have site control | Be flexible | Solve problems |
| Minimize linears | Accept responsibility | Be consistent |
| Avoid T&E species | Know impacts | Listen to public |
| Avoid TL congestion | Know community | Be creative |

Options

| Option | Air | Water | Land | Noise | Bio. Res. |
|---|---|---|---|---|---|
| New Comb. Cycle | | | | | |
| New Simple Cycle | | | | | |
| New Wind | | | | | |
| Restart Steam Turbine | | | | | |
| Restart Biomass | | | | | |
| Natural Gas Barge | | | | | |
| Diesel Locomotive | | | | | |
| Back Up Generator | | | | | |

Permitting Difficulty: Easy | Moderate | Difficult



# Update on the Energy Scenario

***California Energy Commission***
Terrence O'Brien, Deputy Director

**Projects Under Review in the Greater Los Angeles Basin**

| | | |
|---|---|---|
| • Vernon | 134 MWs | 2004 |
| • El Segundo Repower | 630 MWs | 2005 |
| • Inland Empire | 670 MWs | 2005 |
| • Magnolia | 328 MWs | 2005 |

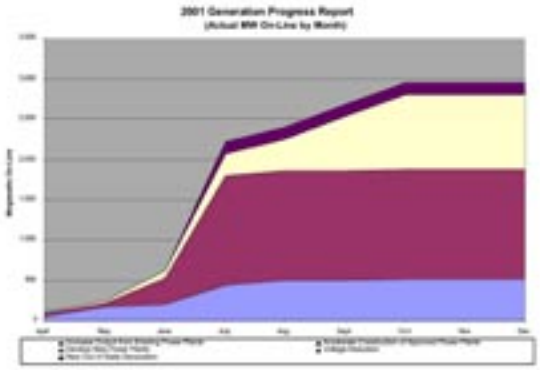
**Energy Commission-Approved Power Plant Projects**

| | | MW On-line by July 31 | | | | |
|---|---|---|---|---|---|---|
| | | 2001 | 2002 | 2003 | 2004 | 2005 |
| Power Plants 200 MW and larger | | | | | | |
| Operating | | 1,415 | 2,172 | | | |
| Under Construction | | | | 3,163 | 750 | 1,110 |
| Power Plants less than 200 MW | | | | | | |
| Operating | | 180 | 594 | | | |
| Under Construction | | | | 480 | | |
| **Total New Generation** | **9,864** | **1,595** | **2,766** | **3,643** | **750** | **1,110** |

## Uncertainties

- Market design changes
- Utility and financial condition
- Industry financial condition
- Plant construction slippage
- Existing plant maintenance
- Role of utility owned generation
- Role of public power
- Provisions for long-term contracts
- ISO structure
- Federal - State relationships

?




## Concluding Thoughts

- The State's role in energy is critical:
  - Long-term planning and information
  - Regulatory review
  - Policy guidance
  - Monitoring and oversight
- Must be performed in a manner that is:
  - Reflective of the broader energy system
  - Cooperative with other government entities

## Implications

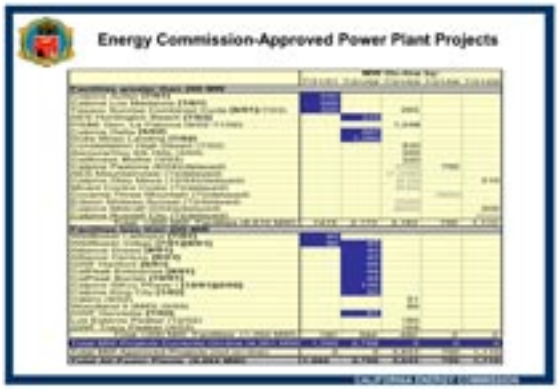
- Positive:
  - The "bureaucracy" can respond
  - Good sites / projects are available
  - The public accepts a real emergency
- Negative:
  - "Planning" was missing
  - Easy to abuse public trust
  - Can't rush problem projects

# Update on the Energy Scenario

***California Energy Commission***
Terrence O'Brien, Deputy Director

## Permitting - Solutions

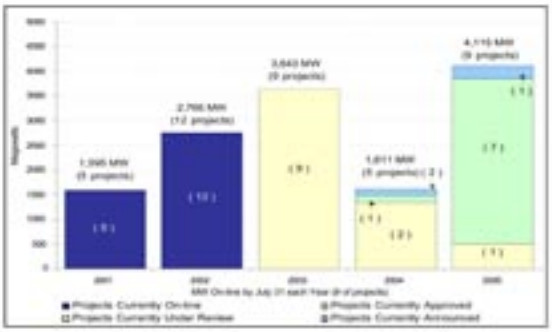
- Agencies
  - 1 Seek solutions
  - 2 Be consistent
  - 3 Meet commitments
  - 4 Coordinate with each other
- Applicants
  - 1 Meet with agencies early and listen
  - 2 File a complete application
  - 3 Minimize project changes
  - 4 Have site control




## 12-Month Permitting Process

- Consolidated state & local permit
- "Certified Regulatory Program"
- Consider:
  - Environmental Impacts / Mitigation
  - Compliance with Legal Requirements
  - Need -- eliminated in 1998
  - Other issues
- Open to public
- Ability to override

## Generation Additions (by 7/31)



# Small Business Assistance Conference

## Parker Boilers

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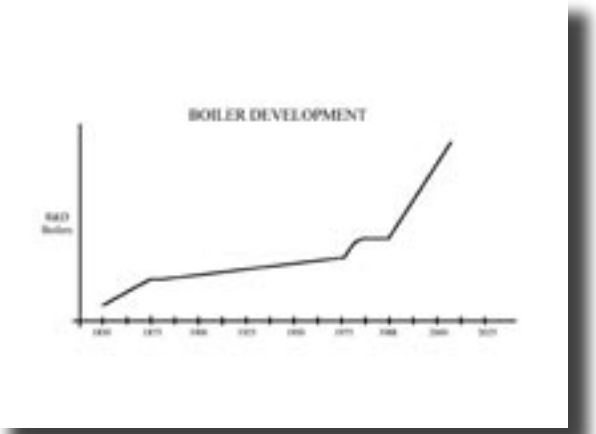
# Update on the Energy Scenario

***Parker Boilers***

Gregory E. Danenhauer, Vice President of Engineering





## 1999 NATIONAL BOARD INCIDENT REPORT
### Power Boilers

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Valve | 1 | 1 | 0 |
| Low Water Condition | 67 | 2 | 1 |
| Limit Controls | 27 | 0 | 0 |
| Improper Installation | 14 | 1 | 0 |
| Improper Repair | 24 | 0 | 0 |
| Faulty Design or Fabrication | 22 | 1 | 0 |
| Operator Error or Poor Maintenance | 143 | 3 | 0 |
| Burner Failure | 27 | 20 | 1 |
| Unknown/Under Investigation | 13 | 0 | 0 |
| SUBTOTALS | 339 | 41 | 2 |
| TOTALS | 2,163 | 136 | 21 |

II. **THE COMBUSTION PROCESS**

- A. Combustion
- B. Factors & Key Words
- C. Formation of NOx
- D. Atmospheric combustion
- E. Power Burners
- F. NOx corrected to 3% $O_2$

**THE KEY WORDS & RULES GOVERNING BOILER DECISIONS ARE:**

1. BACT ( Best Available Control Technology). For AQMD
2. LAER ( Lowest Achievable Emission Rate).
3. Rule 219 ( Permitting Rule, New & Existing Boilers).
4. Rule 1146 ( Retrofit Rule ) Boiler $\leq$ 5 Million BTUH.
5. 1146.1 ( Retrofit Rules ) Boilers 2 $\leq$ 5 Million BTUH.
6. 1146.2 ( New & Retrofit ) Boilers 75,000 - 2.0 Million BTUH.
7. Rule 1121 ( Proposed ) Water Heaters 0 - 75,000 BTUH.
8. Source Test
9. Fees
10. Clean Fuels

**COMBUSTION**

$C + O_2 = CO_2 + HEAT$

$2H_2 + O_2 = 2H_2O + HEAT$

AIR = 20.9% OXYGEN + 79.1% NITROGEN

$CH_4 + 2O_2 + 8N_2 = CO_2 + 2H_2O + 8N_2 + HEAT$

PERFECT COMBUSTION= 10 CU. FT. AIR/ 1 CU. FT. GAS

# Update on the Energy Scenario

***Parker Boilers***

Gregory E. Danenhauer, Vice President of Engineering

**FACTORS & KEY WORDS THAT EFFECT COMBUSTION**

- FLUE GAS
- DRAFT
- COMBUSTION EFFICIENCY
- COMBUSTION FLUE GAS ANALYSIS
- CARBON DIOXIDE / OXYGEN
- EFFECTS OF EXCESS AIR
- CARBON MONOXIDE (CO) (LESS THAN 400 PPM @ 3% $O_2$)
- EFFECTS OF CO

**POWER BURNER**

**NOx EMISSIONS**

1. NOx is formed in all combustion processes known as "Thermal NOx" and/or " Fuel NOx".
2. Fuel NOx is associated with fuels containing bound Nitrogen (Fuel, Oils, Coal).
3. NOx consists of 80 to 95% NO the remainder in $NO_2$.
4. Formed more with increased exposure at high temperatures.

**SMOG**

1. NOx reacts with sunlight to produce Ozone & Photochemical smog.

**NOx CORRECTED TO 3%**

$O_2$ = Oxygen Value in Stack

$\frac{(20.9)-3}{20.9 - O_2}$ = CF (Correction Factor)

at 7% $O_2$

$\frac{20.9-3}{20.9-7} = \frac{17.9}{13.9} = 1.28 = CF$

so if NOx reading is 80 ppm

80 ppm @ 7% $O_2$ is

80 x 1.28 = 102 ppm NOx @ 3% $O_2$



**III. BOILER & BURNER NOx CONTROL STRATEGIES FROM LARGE EQUIPMENT**

| COMBUSTION MODIFICATIONS | FLUE GAS TREATMENT |
|---|---|
| A. Flue gas re-circulation. | H. Clean Fuel |
| B. Staged combustion. | I. Selective Catalytic Reduction |
| C. Low NOx Burners | J. Non-selective Catalytic Reduction |
| D. Reduced Air Preheat | K. Electron Beam Radiation |
| E. Ammonia or Urea injection | L. Chemical Scrubbing |
| F. Low excess air | M. Urea Injection |
| G. $O_2$ Trim | N. LTO (Low Temperature Oxidation) |

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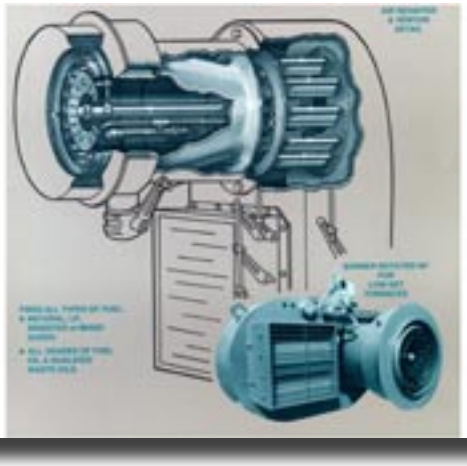

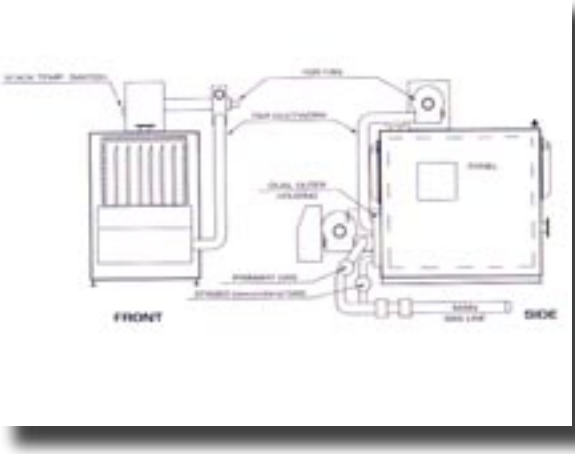


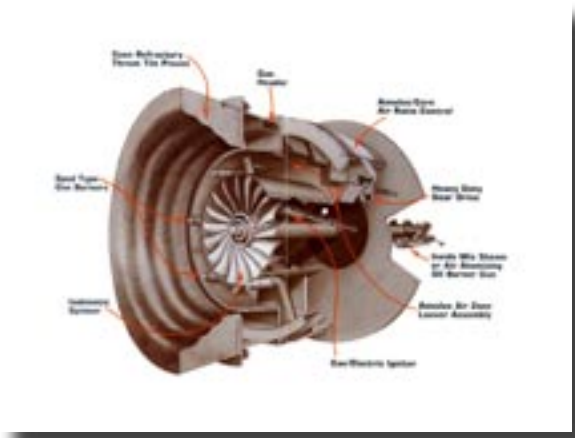

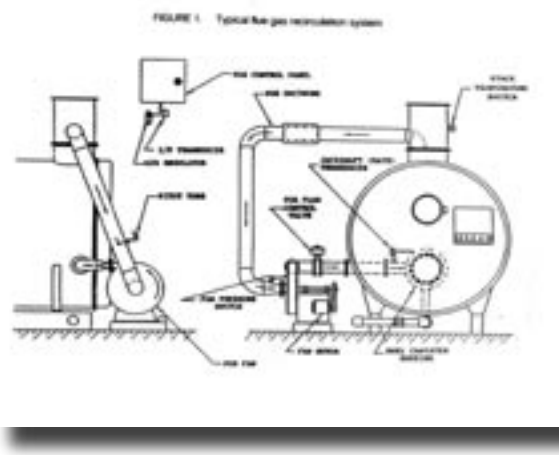

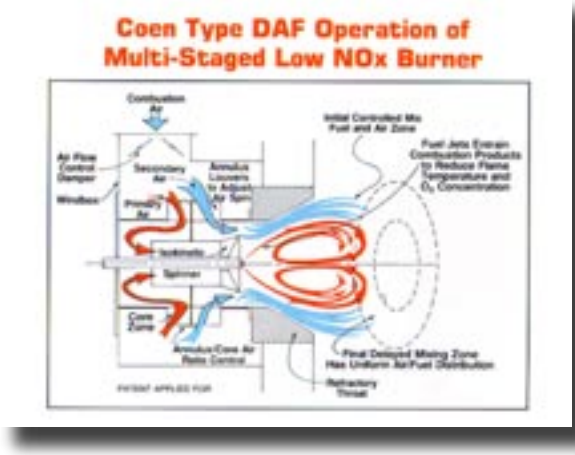

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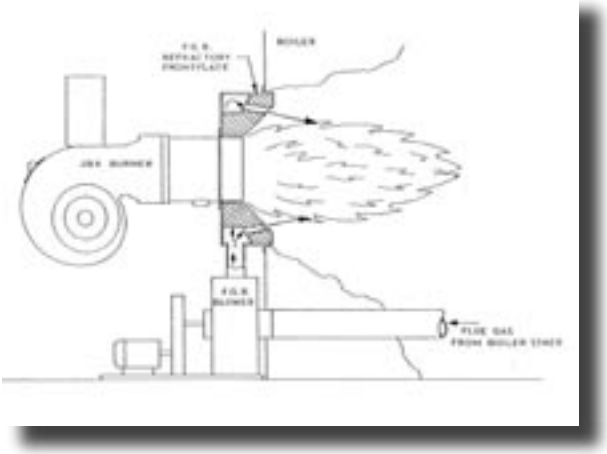


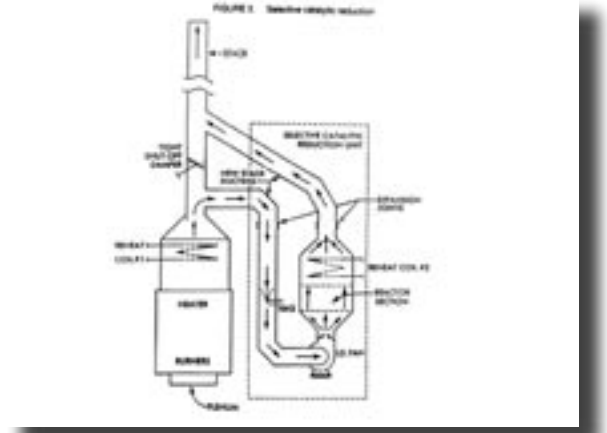

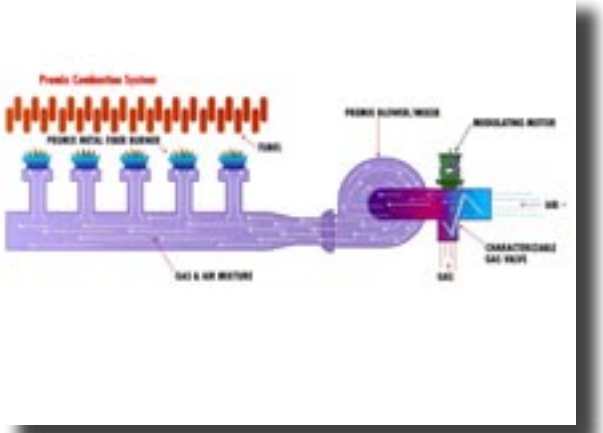

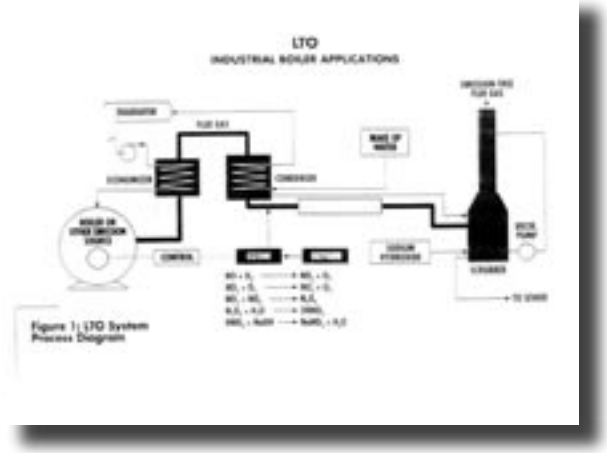


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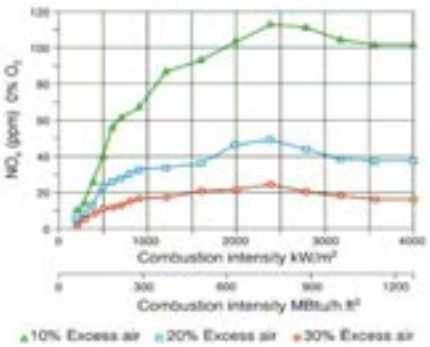
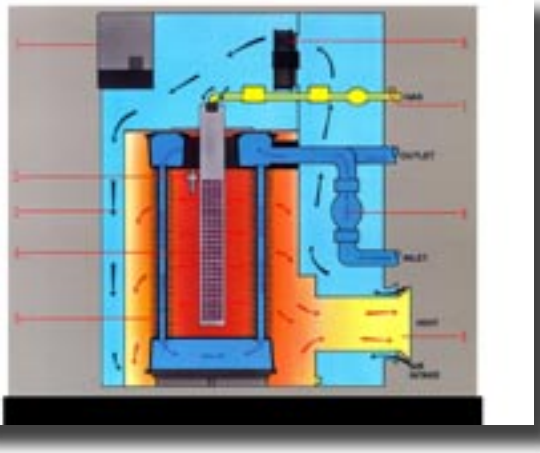



COMPARISON OF PARAMETERS: CONVENTIONAL vs. POWER PREMIX

| Parameters | Power Premix | Conventional Atmospheric |
|---|---|---|
| $O_2$ In Stack | 4.5 - 6 % | 6 - 7.5% |
| Excess Air | 24.5 - 36% | 36 - 58% |
| NOx @ 3% $O_2$ | 25 PPM | 110 PPM |
| CO @ 3% $O_2$ | 50 PPM | 200 PPM |
| Combustion Efficiency Gain | 1 - 2.5% | Baseline |
| Thermal Efficiency Gain | 1 - 3% | Baseline |



WATER TUBE BOILER

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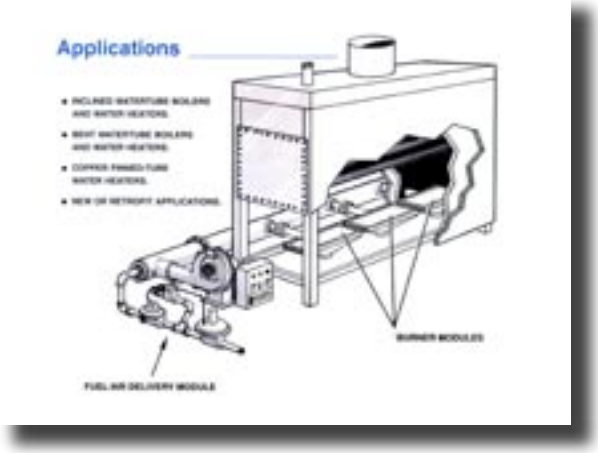


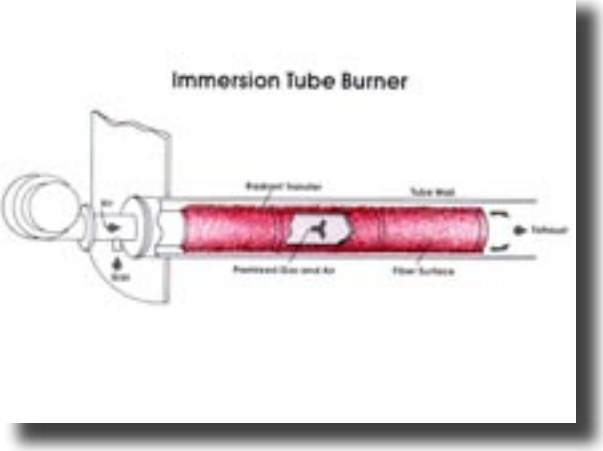


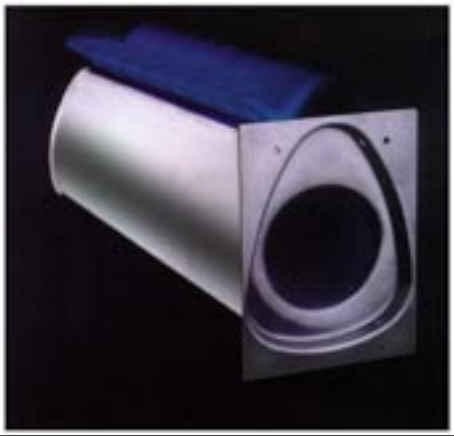

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